https://doi.org/10.29321/MAJ.10.A03445

Madras agric. J. 61 (10—12) : 945—949 Oct—Dec. 1974.

Influence of Nutrient and Green Manure Applications on Nutrient Uptake and Yield of Rice

BY

P. P. RAMASWAMI[1] and D. RAJ[2]

ABSTRACT

A pot culture experiment was conducted on four soil groups to study the effect of application of nitrogen, phosphorus, molybdenum and green manure on the uptake of nitrogen phosphorus and potassium by grain, straw and root and on the yield of rice grain and straw and root growth. Application of nitrogen, phosphorus and green manure increased grain yield. Straw yield was increased by nitrogen and phosphorus fertilization and root growth was increased by nitrogen application alone. Nitrogen and green manure application increased nitrogen uptake by grain; nitrogen, phosphorus, molybdenum and green manure application increased phosphorus uptake and nitrogen and phosphorus application increased potassium uptake by grain. Siginificant correlations were obtained between grain, straw and root growth and uptake of nitrogen, phosphorus and potassium by grain, straw and root.

INTRODUCTION

Fertiliser application plays an important role in the uptake of nutrients and yield of rice plant. With the introduction of many high yielding varieties requiring high nutrient supply, there is an imperative need for effecting economy in fertiliser application. Baba (1954) noticed that at higher nitrogen levels, accumulation of more soluble and non-protein nitrogen took place affecting production of grains. Mahapatra and Sahu (1961) revealed that response to application of phosphorus to rice was lower than for nitrogen. Pawar *et al.* (1960) observed that application of potassium was not beneficial but there was some indication that the effect of phosphorus was enhanced by the application of potassium at higher levels. The present investigation was taken up to study the influence of nitrogen, phosphorus, green manure and molybdenum applications on the uptake of major plant nutrients and the yield of rice grain and straw and development of root in the four soil groups of Tamil Nadu.

MATERIALS AND METHODS

A pot culture experiment with 16 treatments was laid out statistically with Co 32 rice as a test crop on four major soils of Tamil Nadu *viz.*, one black (B) soil and one red (R1) non-calcareous soil from Coimbatore, another red (R2) calcareous soil from Namagiripet and one lateritic (L) soil from Nanjanad

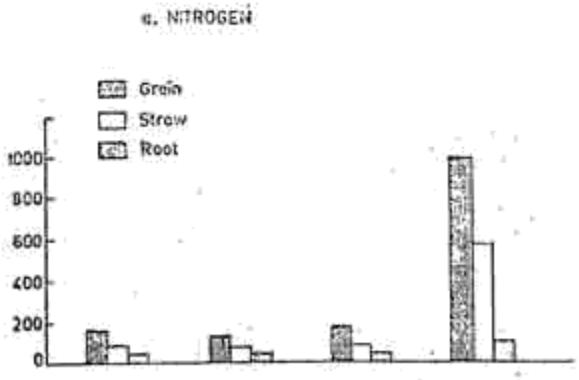
1. Assistant Professor, Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore-641003.
2. Chief Scientist, Regional Agricultural Research Station, Kovilpatti.

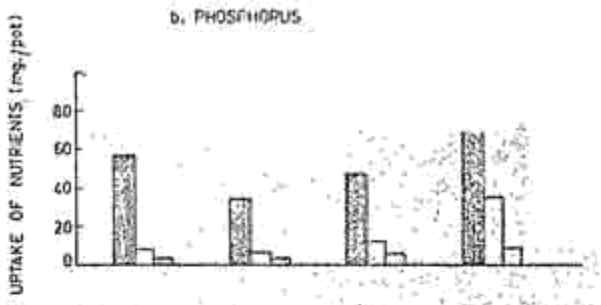
Potassium was applied to all the pots uniformly at 16.80 kg hectare as muriate of potash. Nitrogen at 44.80 kg/hectare (N1) as ammonium sulphate. P_2O_5 at 33.60 kg/hectare (P1) as super phosphate, molybdenum at 4.94 kg/hectare (Mo1) as sodium molybdate and green manure at 5600 kg/hectare (GM1) as sesbania were applied to the respective treatments. N_0, P_0, Mo_0 and GM_0 given below indicate nitrogen, P_2O_5, molybdenum and green manure at O kg level.

Yield of grain and straw were recorded. Root weight was also taken. Analysis of grain, straw and root for total nitrogen, phosphorus and potassium for each treatment under each soil type was carried out. Nitrogen was estimated by micro-kjeldahl method. Phosphorus was estimated colorimetrically by Vanadomolybdate method. Potassium was estimated in the triple acid digest using a EEL flame photometer. Analysis of variance was worked out for the yields of grain, straw and root and for the uptake of nitrogen, phosphorus and potassium by grain and straw.

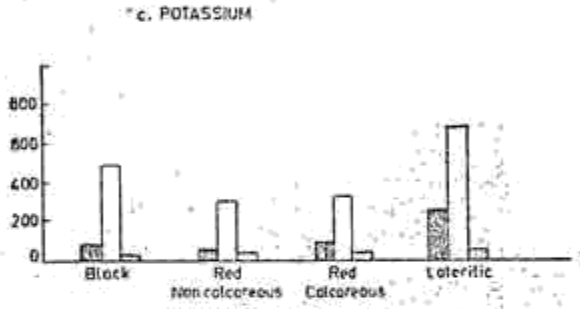
RESULTS AND DISCUSSION

The uptake figures of nitrogen,



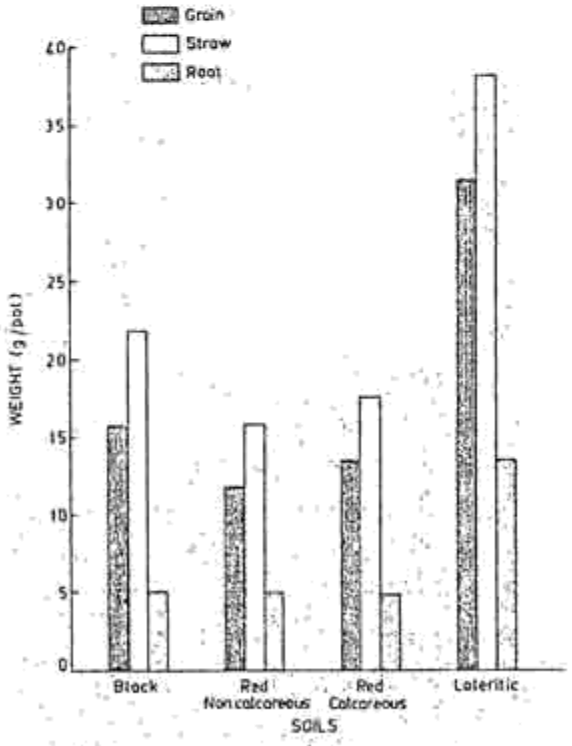


phosphorus and potassium by grain,



straw and root are given in Figure 1.

FIG.2 YIELD OF RICE



The yields of grain, straw and root are given in Figure 2.

Uptake of nutrients by rice

Significant difference in the uptake of nitrogen, phosphorus and potassium by grain, straw and root were noticed. In all the cases lateritic soil recorded maximum uptake. Chandrasekaran (1967) observed that the uptake of nitrogen, phosphorus and potassium was higher in loamy soils for both grain and straw. Nitrogen uptake by rice grain was influenced significantly by nitrogen and green manure applications. Potassium uptake was significantly more due to nitrogen, phosphorus, green manure and molybdenum applications than control. Green manure applications enhanced phosphorus uptake by grain in red and black soils but decreased in lateritic soil presumably because of its original higher content of organic matter. Green manure application in black soil recorded the highest values for grain phosphorus uptake. Kanapathy (1957) recorded in Malayan soils that increasing the phosphorus application increased nitrogen uptake and increasing the nitrogen application increased phosphorus uptake. This is in agreement with the conclusion from the present studies. However, Shimose and Ikemune (1953) observed that phosphorus uptake by rice was not affected by nitrogen fertilisers. Shinde and Datta (1964) observed that application of nitrogen markedly increased phosphorus uptake.

It was observed that nitrogen and phosphorus applications, in general, increased potassium uptake by grain. The trend in uptake of nitrogen, phosphorus and potassium by grains in different soils was similar and it was in the order of lateritic, black, red-calcareous and red-non calcareous. Molybdenum application was beneficial in lateritic soil resulting in significantly higher nitrogen uptake in straw.

Yield of rice:

In general, nitrogen, phosphorus and green manure applications significantly increased yield of grain. Straw yield was significantly increased by nitrogen and phosphorus fertilization. Significant increase in root weight was found with the application of nitrogen alone. Guruswamy (1963) observed that the increase in crop yield by nitrogen was more than with phosphorus. Engelstad and Terman (1966) noticed that crop response to nitrogen was generally greater than with phosphorus and potassium. Green manure application increased yield in red and black soils but decreased the yield in lateritic soil similar to that of uptake of nutrients. The trend with respect to yield of grain, straw and root was similar within the soil types studied and was of the order of lateritic, black and red soils.

High correlations were found between grain and straw, grain and root and yields (Table 1). Close correlations were established between nitrogen, phosphorus and potassium uptake of grain, straw and root. Chandrasekaran (1967) also observed similar correlations for the yields and uptake of nitrogen, phosphorus and potassium by rice at various stage.

TABLE 1.

RESULTS OF STATISTICAL ANALYSIS FOR CORRELATION

S. No.	Relationship between X	Y	Correlation coefficient 'r'	Regression equation
1.	Grain N uptake	Grain P uptake	0.471***	Y=0.03X+7
2.	Grain N uptake	Grain K uptake	0.819***	Y=0.13X+56
3.	Straw N uptake	Straw P uptake	0.796***	Y=0.046X+5.5
4.	Straw N uptake	Straw K uptake	0.637***	Y=0.57X+328
5.	Straw P uptake	Straw K uptake	0.679***	Y=10.3X+291
6.	Root N uptake	Root P uptake	0.846***	Y=0.097X+0.5
7.	Root N uptake	Root K uptake	0.868***	Y=0.269X−5
8.	Root P uptake	Root K uptake	0.870***	Y=4.89X−20.0
9.	Grain N uptake	Straw N uptake	0 972***	Y=0.597X—9
10.	Straw N uptake	Root N uptake	0.849***	Y=0.12X+37
11.	Grain N uptake	Root N uptake	0.844***	Y=0.077X+34
12.	Root weight	Grain Yield	0.766***	Y=1.37X+3.43
13.	Root weight	Straw yield	0.825***	Y=1.75X+10.8
14.	Straw yield	Grain yield	0.963***	Y=0.81X...0.64

Significant at 0.1 %level.

* Number of pairs (N)=64

ACKNOWLEDGEMENT

The permission accorded by the University of ;Madras for publishing this part of the M.Sc. (Ag.) dissertation is gratefully acknowledged. The authors wish to express their deep sense of gratitude to Thiru A. Dhanapalan Mosi, Agricultural Chemist and to Thiru K. S. Nair, Agricultural Chemist for their interest and encouragement shown during the conduct of this study.

REFERENCES

BABA, I. 1954. Report for the 5th meeting of the working party on rice breeding. *Ministry Agric. and Forestry*, Japan 167.

CHANDRASEKARAN, M. 1967. Studies on the progressive uptake of principal plant nutrient elements by paddy undes flooded conditions. M.Sc. (Ag.) Dissertation, University of Madras (Unpublished).

ENGELSTED, O. P. and G. L. TERMAN. 1966. Fertilizer nitrogen. Its role in determining crop yield levels. *Agron J.* 58 : 536-539.

GURUSWAMY, M. 1963. Study of chemical transformations in paddy soils of Madras State in relation to crop growth and yield M. Sc. (Ag.) Dissertation, University of Madras (Unpublished).

KANAPATHI, K. 1957. Mineral nutrition of paddy. 1. Nitrogen and phosphorus uptake of paddy grown on an extremely poor lateritic soil, compared with that of dryland crops. *Malayan agric. J.* 40 : 110-12

MAHAPATRA, I. C. and B. N. SAHU. 1961. Phosphete needs of rice crop *Indian. J. Agron.* 5 : 219-24.

PAWAR, M. S., P.P.V. KRISHNAMOORTHY and K. SITARAMIAH RAO. 1960. Response of potash and its interactions with nitrogen and phosphoric acid in low-land rice. *J. Indian Soc. Soil Sci.* 8 : 89-92.

SHIMOSE, N. and R. IKEMUNE. 1953. Physical and chemical studies on the growth of crops on polder soils. 1. Effects of the fertilization of rice plants grown on halogenetic polder soil. *Soils Fert.* 17 : 371

SHINDE, J. B. and N. P. Datta. 1964. Tracer investigations with P32 on phosphorus nutrition of low land rice as affceted by nitrogen and silica: *Bull. natn. Inst. Sci. India* 26 : 279-14.